QLC-6 Mutation Testing the FindHighestNumber

> In this lab you are not going add any new code, but simply use the PITest tool to examine on the case study classes and see where it might be improved

1. Open the **find-highest-number** project
2. Replace the contents of the pom.xml with the following code

```
<?xml version="1.0" encoding="UTF-8"?>
<project xmlns="http://maven.apache.org/POM/4.0.0" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://maven.apache.org/POM/4.0.0 http://maven.apache.org/xsd/maven-4.0.0.xsd">
    <modelVersion>4.0.0</modelVersion>
    <groupId>com.s2s.demos</groupId>
    <artifactId>find-highest-number</artifactId>
    <version>1.0-SNAPSHOT</version>
    <packaging>jar</packaging>
    <dependencies>
        <dependency>
            <groupId>junit</groupId>
            <artifactId>junit</artifactId>
            <version>4.12</version>
            <scope>test</scope>
        </dependency>
        <dependency>
            <groupId>org.hamcrest</groupId>
            <artifactId>java-hamcrest</artifactId>
            <version>2.0.0.0</version>
            <scope>test</scope>
        </dependency>
        <dependency>
            <groupId>org.mockito</groupId>
            <artifactId>mockito-junit-jupiter</artifactId>
            <version>4.8.1</version>
            <scope>test</scope>
        </dependency>
        <dependency>
            <groupId>org.pitest</groupId>
            <artifactId>pitest-parent</artifactId>
            <version>1.19.1</version>
            <type>pom</type>
        </dependency>

    </dependencies>

    <properties>
        <project.build.sourceEncoding>UTF-8</project.build.sourceEncoding>
        <maven.compiler.source>11</maven.compiler.source>
        <maven.compiler.target>11</maven.compiler.target>
    </properties>

    <build>
        <plugins>
            <plugin>
                <groupId>org.pitest</groupId>
```

```
                <artifactId>pitest-maven</artifactId>
                <version>1.19.1</version>
                <configuration>
                    <targetClasses>
                        <param>com.s2s.demos.findhighestnumber.mutations.HighestNumberFinder</param>
                    </targetClasses>
                    <targetTests>
                        <param>com.s2s.demos.findhighestnumber.mutations.HighestNumberFinderTest</param>
                    </targetTests>
                </configuration>
            </plugin>
        </plugins>
    </build>
</project>
```

3. Open the TopicManagerTest file and locate the test
   `find_heighest_score_with_array_of_many_return_array_of_many_using_stub`
4. Disable the test by adding the annotation `@Ignore`
5. From the command line, execute the following commands
6. ```
   mvn clean package
   mvn org.pitest:pitest-maven:mutationCoverage
   ```
7. Examine the report and see how the code could be improved

   HighestNumberFinder.java

```
1  package com.s2s.demos.findhighestnumber.mutations;
2
3  /**
4   *
5   * @author selvy
6   */
7  public class HighestNumberFinder
8  {
9      int findHighestNumber(int[] array)
10     {
11         int highestSoFar = Integer.MIN_VALUE;
12
13         for( int val : array )
14         {
15 2           if( val > highestSoFar )
16                highestSoFar = val;
17         }
18 1       return highestSoFar;
19     }
20 }
```

   Mutations

```
15  1. changed conditional boundary → SURVIVED Covering tests
    2. negated conditional → KILLED
18  1. replaced int return with 0 for com/s2s/demos/findhighestnumber/mutations/HighestNumberFinder::findHighestNumber → KILLED
```

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```